CANADA
DEPARTMENT OF AGRICULTURE
EXPERIMENTAL FARMS SERVICE

DISTRICT EXPERIMENT SUBSTATION

CRESTON, B.C.

F. M. CHAPMAN, B.S.A., Resident Research Officer

PROGRESS REPORT 1949-1954

Experimental Plots, Creston, B.C.

EXPERIMENTAL FARM, LETHBRIDGE, ALBERTA
H. CHESTER, B.S.A., Superintendent

Published by authority of the Rt. Hon. JAMES G. GARDINER, Minister of Agriculture,
Ottawa, Canada

2500—21895-6-56

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INTRODUCTION

The Experiment Substation was established in 1938 on the reclaimed river flats of the Creston Valley. The Substation comprises twenty acres of silty clay and is located three miles west of the Village of Creston. The soil is similar to the type prevailing on the 20,000 acres of reclaimed river flats.

The early work at the Substation was to a large extent of an exploratory nature. A wide variety of crops were grown to determine their productive possibilities. Varieties of small fruits, tree fruits and vegetable crops, cereals and forage crops were included. The second phase of experimental work has been focused on the crops which showed fair promise or were being grown by the farmers throughout the area.

The trend in crop production has been towards cereal grains and seed peas. Favorable prices during the war years and immediately following made this type of farming very attractive. Moreover the danger of flooding resulting from abnormally high spring water of the Kootenay River has favored short-term cropping. The area was flooded in 1938 and 1948 resulting in complete crop failures.

Problems confronting this type of farming were the lack of suitable varieties and information on suitable fertilizers. Considerable progress has been made at the Substation in solving these problems. Attention has also been given to the possibilities of more permanent crops, such as hay and pasture, and recommendations based on experimental evidence are now available.

In recent years small-fruit and vegetable production has shifted from the upper bench lands to the reclaimed river flats, the main reason being the lack of land area on the benches. This has necessitated further experimental work at the Substation. Dry, midsummer conditions can be overcome by the use of a sprinkler irrigation system. The work on fertilizers for strawberries and production records for raspberry varieties has not sufficiently progressed to be included in this report.

Meteorological Records

The meteorological records included in this report were compiled from data recorded at Creston by the Department of Transport. Despite the relatively low annual precipitation of 18·18 inches, yields of cereal grains and forage crops are fairly high. This can be attributed largely to the absence of windy weather and to low evaporation. Heavy dew during the spring and early fall is also a contributing factor. The variation in annual precipitation is great, from a low of 8·79 inches in 1944 to a high of 25·22 inches in 1950. Less than one-third of the precipitation falls during the growing season. The remaining portion is to a large extent received in the form of snow. In January, 1954, snowfall of 59·10 inches established a record high for the seventeen-year period.

The temperature fluctuations are also great, with the number of frost-free days varying from a low of 83 days in 1946 to a high of 152 days in 1953. The period free of killing frosts is considerably greater than the frost-free period. A difference of 48 days was recorded on the basis of a seventeen-year average. The period free of killing frosts also varied greatly, from a low of 135 days in 1946 to a high of 207 days in 1940.

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TABLE 1.—MONTHLY AND ANNUAL PRECIPITATION IN INCHES, 1938-1954, CRESTON, B.C.

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1938	1·93	2·34	2·06	0·86	0·43	1·20	0·74	0·50	0·59	1·72	1·45	2·85	16·67
1939	2·67	0·84	0·54	0·02	0·79	2·61	0·39	T	1·04	1·60	1·08	2·99	14·57
1940	1·14	2·22	1·93	0·71	0·79	0·63	1·05	0·24	2·17	1·75	1·77	2·26	16·66
1941	1·92	0·83	0·89	0·23	2·22	1·74	0·91	1·57	1·63	1·09	2·05	3·44	18·52
1942	0·96	0·75	0·59	0·48	4·17	3·05	1·91	0·40	0·84	1·21	3·40	1·76	19·52
1943	2·83	1·65	1·42	1·75	0·62	2·06	1·06	0·83	0·17	2·22	0·85	1·10	16·56
1944	0·96	0·49	0·28	0·45	0·81	1·10	0·58	0·32	0·92	0·47	1·09	1·32	8·79
1945	1·32	1·52	2·48	1·51	1·18	1·75	0·20	0·29	1·30	1·80	3·20	2·82	19·37
1946	3·03	2·40	1·39	1·40	1·03	2·30	0·56	1·46	1·35	1·33	4·27	2·21	22·73
1947	2·11	1·27	0·67	0·86	0·68	2·57	0·58	1·30	1·45	4·03	0·72	1·78	18·02
1948	1·55	2·61	0·51	0·94	1·66	2·80	1·75	0·63	0·38	0·57	2·59	2·79	18·78
1949	0·53	2·99	0·70	0·59	0·83	1·10	0·91	0·41	0·74	1·61	1·15	3·27	14·83
1950	4·20	2·11	2·61	0·81	0·14	2·16	1·47	1·61	0·42	4·89	2·36	2·44	25·22
1951	3·48	2·36	1·12	1·28	1·39	1·29	0·73	2·37	1·95	2·86	2·64	2·28	23·75
1952	2·93	0·97	0·93	0·72	0·56	4·52	0·03	0·28	0·66	0·21	0·40	1·59	13·80
1953	4·69	1·29	0·87	1·88	0·97	1·94	0·54	2·35	0·40	1·03	1·57	2·27	19·80
1954	5·91	2·25	0·99	1·57	1·10	1·79	0·96	2·94	0·33	0·59	1·45	1·61	21·49
17-year average	2·48	1·70	1·18	0·94	1·14	2·04	0·85	1·03	0·96	1·70	1·88	2·28	18·18

SOURCE.—Meteorological Service of Canada

TABLE 2.—OCCURRENCE OF FROST AND FROST-FREE PERIODS, 1938-1954, CRESTON, B.C.

Year	Frost: 32° (F.) or lower					Killing frost: 28° (F.) or lower				
	Last frost in spring		First frost in fall		Frost-free period	Last killing frost in spring		First killing frost in fall		Killing-frost-free period
	Date	Temperature (deg.)	Date	Temperature (deg.)	(days)	Date	Temperature (deg.)	Date	Temperature (deg.)	(days)
1938	June 10	32	Oct. 13	32	125	Apr. 21	27	Oct. 14	25	176
1939	June 1	32	Sept. 29	32	120	Apr. 26	26	Oct. 25	24	192
1940	Apr. 30	29	Oct. 6	32	159	Apr. 11	28	Nov. 4	25	207
1941	May 19	31	Oct. 5	31	139	Apr. 19	27	Oct. 29	28	193
1942	May 17	32	Oct. 13	30	149	Mar. 30	28	Oct. 18	28	201
1943	May 16	32	Sept. 19	30	126	May 13	28	Oct. 14	23	184
1944	May 4	32	Sept. 17	27	136	May 3	27	Sept. 17	27	137
1945	June 12	32	Sept. 9	32	89	Apr. 28	26	Sept. 27	26	152
1946	June 28	32	Sept. 19	30	83	May 10	25	Sept. 22	25	135
1947	May 17	31	Sept. 14	32	120	Apr. 23	28	Nov. 4	24	194
1948	May 5	32	Sept. 24	32	143	Apr. 14	28	Oct. 6	27	174
1949	May 5	32	Sept. 12	30	130	Apr. 9	28	Oct. 14	28	188
1950	May 18	32	Sept. 28	31	133	Apr. 4	27	Oct. 3	26	182
1951	May 31	31	Sept. 26	28	118	Apr. 22	28	Sept. 26	28	156
1952	June 13	31	Sept. 13	32	92	Apr. 21	27	Oct. 14	27	176
1953	May 23	32	Oct. 2	29	152	Apr. 12	28	Oct. 25	28	194
1954	May 7	31	Sept. 29	31	145	May 2	26	Oct. 1	26	153
17-year average	May 22	—	Sept. 26	—	127	Apr. 21	—	Oct. 12	—	175

EXTREMES, 1938-1954

Latest spring frost: June 28, 1946,—32°F.
Earliest date of last spring frost: Apr. 30, 1949,—29°F.
Earliest fall frost: Sept. 9, 1945,—30°F.
Latest date of first fall frost: Oct. 22, 1953,—29°F.

Latest spring killing frost: May 13, 1945,—28°F.
Earliest date of last killing frost: Mar. 28, 1942,—28°F.
Earliest fall killing frost: Sept. 27, 1944,—27°F.
Latest date of first killing frost: Nov. 4, 1947,—24°F.
Nov. 4, 1940,—25°F.

Shortest crop season: 1944—83 frost-free days; 135 crop days.
Longest crop season: 1940—159 frost-free days; 207 crop days.

Very little sub-zero weather occurs during the winter season. The heavy snowfall provides protection for the overwintering plants and shrubs. Intermittent mild spells during the winter melt the snow and the resulting moisture is absorbed by the unfrozen soil. Spring temperatures complete the melting, which results in an over-abundance of moisture. The high water-holding capacity of the silty clay soil prevents rapid drying and rise in soil temperature. This slows down the spring growth of plant species with relatively high heat requirements.

TABLE 3.—AVERAGE MONTHLY TEMPERATURE, CRESTON, B.C.

(Degrees Fahrenheit)

Month	Year						Average 6 years
	1949	1950	1951	1952	1953	1954	
January	11	10	26	22	37	24	22
February	22	29	29	30	34	33	30
March	34	34	32	35	39	34	35
April	49	—	46	47	44	42	46 (5)
May	58	53	54	54	54	54	54
June	62	60	59	58	57	56	59
July	66	66	68	65	66	64	66
August	67	65	65	65	66	66	66
September	59	60	55	59	57	55	58
October	43	45	44	49	48	48	46
November	39	34	34	33	38	40	36
December	29	33	21	31	34	31	30
Mean annual temperature	45	44	44	46	48	46	46
Extreme high temperature	93	92	96	94	91	88	
Calendar date	Aug. 6	Aug. 22	Aug. 2	Aug. 5	July 30	July 18	
Extreme low temperature	−13	−20	− 4	− 9	17	−11	
Calendar date	Jan. 20	Jan. 15	Dec. 24, 26	Jan. 3	Jan. 6	Jan. 20	

(5) Indicates a five-year average.

SOURCE: Meteorological Service of Canada.

SOIL FERTILITY

Since the reclamation of the river flats, cereal grains and seed peas have been the most important crops grown. Short-term cropping systems are favored over long-term rotations involving the use of grasses and legumes. One of the problems arising out of this system of cropping was the fertilizer requirements for cereal grains. During the early years of the Substation the fertilizer work was mainly of an exploratory nature. Fertilizer materials used varied somewhat from year to year and it was difficult to arrive at definite conclusions resulting from the response of the various elements. The results, however, did indicate that small amounts of nitrogen and potassium plus comparatively large amounts of phosphorus were beneficial to yield increases. On the basis of these indications, a study of rates of the complete fertilizer being most widely used was undertaken in 1950. In order to determine the most suitable formula, a project of this nature was started in 1952.

The rod-row method of seeding has been used on all fertilizer tests carried out on cereal grains at the Substation. Both fertilizer and grain are carefully weighed prior to seeding. The Kemp V-belt seeder was used and the fertilizer and grain drilled in one operation, with the fertilizer in direct contact with the seed. It has been necessary to seed all fertilizer trials on summerfallow to overcome the problem of volunteer grain. Spring wheat, winter wheat, oats and barley have been used as indicator crops to measure response.

Studies of Fertilizer Rates and Formulae on Cereals

Various rates of different fertilizer formulae were studied for their effect on spring wheat, oats, and barley. The results are presented in Tables 4, 5, 6, 7, and 8.

TABLE 4.—THE EFFECT OF CHEMICAL FERTILIZER RATES ON CEREALS

Spring Cereals: 5-year average Winter Wheat: 3-year average

Crop	Rate per acre: 6-30-15 Fertilizer			
	Check	50 lb.	100 lb.	200 lb.
	bu.	bu.	bu.	bu.
Spring Wheat—				
Regent	32·7	46·9	51·5	55·2
Oats—				
Ajax	107·6	126·3	136·1	137·9
Barley—				
Plush	74·6	86·0	100·0	93·1
Winter Wheat—				
Elgin	51·8	55·6	59·1	66·5
Kharkov	53·7	61·7	64·0	62·4

Maturity—The maturity of the winter wheat was not affected by the fertilizer treatments. The spring wheat and oats on all rates were four days earlier and the barley three days earlier than the check.

Length of Straw—Small increases resulted from the fertilizer treatments. This was not considered an important factor in evaluating the varieties. Kharkov exhibited the greatest length (54 inches) and this is considered conducive to lodging.

Resistance to lodging—A small amount of lodging was evident in the spring grains during the 1950 season. Good strength of straw was obtained in all treatments during the four remaining test seasons. Severe lodging occurred in all treatments with Kharkov winter wheat. This condition was aggravated by the two heaviest applications of fertilizer. Elgin has been more resistant than Kharkov to lodging.

Weight per bushel—No significant differences in weight per bushel were evident between fertilizer treatments. The two heaviest applications of fertilizer lowered the bushel weight of Kharkov winter wheat, while Elgin was unaffected by the treatments. Early lodging of Kharkov as aggravated by the heaviest rates of fertilizer may have adversely affected the weight per bushel.

Yield response

The 50-pound rate resulted in a five-year average increase of 14·2 bushels of Regent spring wheat over that of the check. An additional 50 pounds of fertilizer resulted in a further increase amounting to 4·6 bushels per acre. The 200-pound application increased the yield 3·7 bushels over that of the 100-pound rate. The most economical rate of application ranged from 50 to 100 pounds of 6-30-15 per acre.

The trend in response with Ajax oats was similar to that on spring wheat. The yield from the 50 pounds of fertilizer increased the yield 18·7 bushels per acre over the check. A further increase over the 50-pound rate resulted from the 100-pound application and amounted to 9·8 bushels per acre. The 200-pound rate produced an increase of 1·8 bushels per acre over that of the 100-pound rate.

With Plush barley the 50 pound application of 6-30-15 resulted in an 11·4 bushel increase over the check during the five-year test period. An additional 50 pounds per acre, which makes up to 100-pound application, brought about a further increase of 14·0 bushels per acre. The increase for this application averaged 25·4 bushels per acre for the test period. The 200-pound application produced a yield response of 18·5 bushels per acre, which is a decrease in yield of 6·9 bushels below that of the 100-pound rate.

The response on winter wheat was not so great as that obtained from the spring cereals. Yield increases from Kharkov were higher than from Elgin on the two lowest rates applied. The yield response for Elgin from the 200-pound application was an increase of 7·4 bushels over the 100-pound rate. A decrease of 1·6 bushels resulted when comparing the yields of Kharkov at the 100-pound rate with that of the 200-pound application.

TABLE 5.—COMPARATIVE RESPONSE OF CHEMICAL FERTILIZER RATES ON CEREALS

Increased Yields over Check at each Level in pounds per acre 5-year average, 1950-54

Treatment per acre	Spring Wheat Regent	Oats Eagle	Barley Plush	Average
	lb.	lb.	lb.	lb.
50 lb. 6-30-15	846	642	547	678
100 lb. 6-30-15	1,124	972	1,219	1,105
200 lb. 6-30-15	1,350	1,033	883	1,089

FIG. 1.—Response of Ajax oats to fertilizer. The plot on the left received no fertilizer while that on the right received 100 pounds per acre of 6-30-15

The greatest response from fertilizer regardless of rate was obtained from Regent spring wheat. The increases obtained from the oats and barley were similar. For the three cereals, the 100-pound application is recommended as the most suitable rate. The wheat and oats were more responsive to the 200-pound application than the barley.

TABLE 6.—EFFECT OF CHEMICAL FERTILIZER TREATMENTS ON REDMAN SPRING WHEAT

Fertilizer analysis	Rate per acre	Yield per acre			3-year average increase
		1952	1953	1954	
	lb.	bu.	bu.	bu.	bu.
Check	—	48·3	41·7	29·9	—
21-0-0	50	45·4	42·3	28·5	−1·2
11-48-0	50	50·3	47·6	35·2	4·3
11-48-0	100	51·1	43·3	36·0	3·5
0-12-20	100	51·7	49·7	42·8	8·1
0-12-20	200	54·4	52·0	45·7	10·7
6-30-15	75	56·2	51·1	43·3	10·2
6-30-15	150	54·8	53·0	48·3	12·0

Maturity—All fertilizer treatments with the exception of 21-0-0 (ammonium sulphate) hastened maturity by 5 days.

Resistance to lodging—Only slight differences in strength of straw were recorded. The application of 21-0-0 and 11-48-0 had a tendency to lower the resistance.

Length of straw—Small variations occurred and the differences were not considered significant.

Weight per bushel—All fertilizer treatments increased the bushel weight, with greatest increases being obtained from the 0-12-20 and 6-30-15 fertilizers.

All bushel weights were above the required 60 pounds on all treatments with the exception of the check plot. A three-year average of 59·6 pounds per bushel was obtained from the check treatment.

Yield response—The application of 21-0-0 at 50 pounds per acre decreased the yield of threshed grain. The addition of phosphorus as in 11-48-0 gave small increases over the check. The most favorable responses were obtained from the combinations of phosphorus and potassium as in 0-12-20 and 6-30-15.

TABLE 7.—EFFECT OF CHEMICAL FERTILIZER TREATMENTS ON EAGLE OATS

Fertilizer analysis	Rate per acre	Yield per acre			3-year average increase
		1952	1953	1954	
	lb.	bu.	bu.	bu.	bu.
Check	—	125·4	94·8	87·1	—
21-0-0	50	144·4	96·7	89·3	7·7
11-48-0	50	135·0	109·8	95·3	10·9
11-48-0	100	118·5	94·0	97·6	1·0
0-12-20	100	141·4	117·1	121·0	24·0
0-12-20	200	155·4	115·0	120·2	27·8
6-30-15	75	144·1	119·6	120·5	25·6
6-30-15	150	138·1	115·5	127·1	24·4

Maturity—All fertilizer treatments with the exception of 21-0-0 (ammonium sulphate) hastened maturity by 5 days.

Resistance to lodging—The 0-12-20 and 6-30-15 fertilizers produced a stronger straw than that of the check. The 21-0-0 and 11-48-0 showed a slight tendency to increase the amount of lodging.

Length of straw—Small variations occurred between treatments and between years but were not important in evaluating the fertilizer treatments.

Weight per bushel—All fertilizer treatments increased the bushel weight with the greatest increases being obtained from the 0-12-20 and 6-30-15 fertilizers.

Yield response—A small increase in yield resulted from the use of 21-0-0, while the results from 11-48-0 were erratic. The greatest and most consistent responses were obtained from 0-12-20 and 6-30-15 fertilizers. The application of phosphorus and potassium is necessary for maximum yields.

TABLE 8.—EFFECT OF CHEMICAL FERTILIZER TREATMENTS ON VANTAGE BARLEY

Fertilizer analysis	Rate per acre	Yield per acre			3-year average increase
		1952	1953	1954	
	lb.	bu.	bu.	bu.	bu.
Check	—	107·9	50·9	62·7	—
21-0-0	50	102·9	50·9	55·9	−3·9
11-48-0	50	104·4	72·5	72·9	9·4
11-48-0	100	96·8	66·9	60·4	0·8
0-12-20	100	120·3	83·2	88·5	20·3
0-12-20	200	120·3	92·2	98·8	29·9
6-30-15	75	121·2	90·3	88·8	26·2
6-30-15	150	121·8	92·4	101·0	31·2

Maturity—Maturity was hastened three days by the 0-12-20 and 6-30-15 fertilizers. The 11-48-0 hastened maturity by two days, while the 21-0-0 treatment was equal to that of the check.

Resistance to lodging—No differences in strength of straw were observed as a result of fertilizer treatments.

Length of straw—The small differences in length were not considered an important factor in evaluating the treatments.

Weight per bushel—All fertilizer treatments increased the bushel weight. The greatest increases were obtained from the 0-12-20 and 6-30-15 fertilizers.

Yield response—The application of 21-0-0 at 50 pounds per acre depressed the yield. The response from 11-48-0 at 50 pounds per acre was favorable but the 100-pound application was not economical. The greatest increases in yield were obtained from the 0-12-20 and 6-30-15 fertilizers applied at the higher rates.

Effects of Trace Elements

In work previously carried out at the Substation, it was observed that boron was essential for higher germination and normal seedling growth in seed peas. Broadcasting borax at 10 pounds per acre was recommended to overcome this deficiency. Difficulty was encountered in carrying out this recommendation which required mixing the borax with dry sand in order to obtain even distribution.

During 1950 and 1951 borax was mixed with Laxton's Progress peas prior to seeding at 1, 2, and 4 ounces per bushel. A check plot was included for comparative purposes. Attempts to evaluate the treatments on the basis of yield were not successful. No significant differences were obtained between treatments.

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FORAGE CROPS

Although considerable alfalfa has been grown on the upper bench area, a very limited acreage on the reclaimed river flats is devoted to growing of hay and pasture. The main objectives at the Substation have been to determine the productive capacity of the area and the performance of the most common species of forage crops. Pasture trials of mixtures are clipped to simulate grazing and two cuts per year have been cut from the hay plots. Estimated botanical analyses are taken on the pasture plots prior to each clipping to show the percentage of clover, grass, and weeds in the pasture sward.

Harvesting of the plots is done by means of a small power mower equipped with a cutting-bar in front. A strip the width of the cutting bar is taken for the full length of each plot. Green weights are recorded at time of harvest and dry-matter determinations are made on representative samples taken from each plot. Yields are based on green weight and dry matter for pastures, and green weight and hay weight for hay yields. Hay weight was calculated on the basis of dry matter plus 12 per cent moisture.

Grasses and Legumes for Hay and Pasture

Two alfalfa varieties, Ladak and Grimm, were tested for productivity under local conditions of soil and climate. Another problem that has been studied on the Substation is the productivity and grazing performance of seeding mixtures. Results of these studies are presented in Tables 9, 10, 11, 12, and 13.

TABLE 9.—HAY YIELDS PER ACRE OF TWO ALFALFA VARIETIES

Dry hay (12 per cent moisture)

Year	First-Cut		Second-Cut		Yearly Total	
	Grimm	Ladak	Grimm	Ladak	Grimm	Ladak
	tons	tons	tons	tons	tons	tons
1950	2·68	2·50	1·63	1·88	4·30	4·38
1951	2·10	2·00	1·70	1·60	3·80	3·60
1952	2·60	2·60	1·90	1·80	4·50	4·40
1953	2·40	2·60	1·90	1·60	4·30	4·20
1954	3·04	2·74	1·45	1·65	4·49	4·39
Average	2·56	2·49	1·72	1·71	4·28	4·20

The first-cut yield of Grimm exceeded that of Ladak for the five-year period, while the second-cut yield was equal for both varieties. The seasonal yield of Grimm exceeded that of Ladak by a small margin. The seasonal yields throughout the test period are consistent, with the greatest portion of the yield being obtained from the first-cut.

TABLE 10.—YIELDS OF HAY MIXTURES

5-year average, 1950-54

Mixture No.	Species and rate of seeding in pounds per acre	Yield per acre	
		Green weight	Dry Weight (12% moisture)
		tons	tons
1	Ladak 6, timothy 4, alsike 2, red clover 3	17·54	4·71
2	Ladak 6, orchard 5, alsike 2, red clover 3	15·78	4·53
3	Ladak 6, brome 6, alsike 2, red clover 3	17·15	4·79
4	Ladak 6, timothy 4, ladino 2, red clover 3	17·79	4·77

Orchard grass was slightly lower in yield than brome grass or timothy when grown with a similar mixture of alfalfa, alsike, and red clover. When ladino clover was used to replace alsike the yield was similar and not affected. Orchard grass is too early to be compatible in maturity with alfalfa and the clovers. Brome was the most suitable in this respect. Timothy was later in maturity than the alfalfa and clovers.

TABLE 11.—GRASS SPECIES GROWN IN COMBINATION WITH LADAK ALFALFA

5-year average, 1950-54

Mixture No.	Species and rate of seeding per acre	Yield per acre	
		Green weight	Dry weight (12% moisture)
		tons	tons
1	Ladak 8, orchard 9	16·61	4·68
2	Ladak 8, brome 12	17·14	4·89
3	Ladak 8, timothy 7	18·77	4·91
4	Ladak 8, orchard 5, brome 6	16·27	4·71
5	Ladak 8, orchard 5, timothy 3	16·85	4·79
6	Ladak 8, brome, 6 timothy 3	18·54	5·19

Timothy and brome grass were more suitable than orchard grass when grown in combination with Ladak alfalfa. Timothy and brome are suitable from the standpoint of maturity. When the alfalfa is at the most suitable stage of maturity for cutting, the orchard grass is fully headed out and partially mature. This tends to lower the quality of the hay.

Green yields were included in Tables 10 and 11 as they provide useful information if the crops are used for making silage.

Pasture Mixtures

Six pasture mixtures and the yields of dry matter obtained are given in Table 12.

TABLE 12.—YIELDS OF GRASS-LEGUME PASTURE MIXTURES

5-year average, 1950-54

Mixture No.	Species and rate of seeding per acre	Yield of dry matter per acre
		lb.
1	Brome 7, orchard 7, Ladak 2	8480
2	Brome 7, creeping red fescue 7, white Dutch clover 2	6560
3	Timothy 4, creeping red fescue 7, white Dutch clover 2	6760
4	Orchard 7, creeping red fescue 7, white Dutch clover 2	5900
5	Orchard 7, Kentucky blue 7, white Dutch clover 2	5960
6	Brome 6, orchard 4, Kentucky blue 2, white Dutch clover 2, Ladak 2	7140

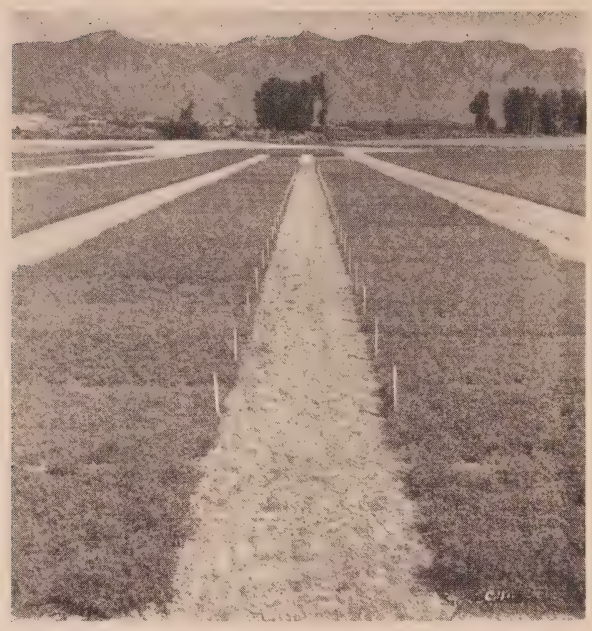

FIG. 2.—Plots of grass-legume mixtures for hay at the Creston Substation.

The two mixtures containing alfalfa were the highest yielders, but as may be noted by comparing mixtures No. 1 and 6, the addition of Kentucky blue grass and white Dutch clover caused a decrease in yield. Timothy was superior to brome and orchard grass when grown in association with creeping red fescue and white Dutch clover. In comparing creeping red fescue with Kentucky blue grass, small differences in yield were obtained. Alfalfa was more productive than white Dutch clover. It excelled in total yield and in distribution of yield throughout the growing season. During the dry midsummer period, it was obvious that alfalfa was much more tolerant of dry conditions than the more shallow-rooted white Dutch clover.

TABLE 13.—COMPOSITION OF GREEN PASTURE HERBAGE FROM SIX MIXTURES

5-year average, 1950-54

Mixture No.	Species and rate of seeding per acre	Percentage		
		Clover	Grass	Weeds
		%	%	%
1	Brome 7, orchard 7, Ladak 2	29	71	0
2	Brome 7, creeping red fescue 7, white Dutch clover 2	18	80	2
3	Timothy 4, creeping red fescue 7, white Dutch clover 2	21	77	2
4	Orchard 7, creeping red fescue 7, white Dutch clover 2	17	81	2
5	Orchard 7, Kentucky blue 7, white Dutch clover 2	16	82	2
6	Brome 6, orchard 4, Kentucky blue 2, white Dutch clover 2, Ladak 2	31	69	0

The composition of herbage obtained by clipping can be used as a criterion in evaluating the quality. In Table 13 the composition of pastures resulting from six mixtures is given. In the growing of various species in association with one another the problem of obtaining a proper balance between clover and grass

content is a major one. Alfalfa was superior to white Dutch clover in maintaining a suitable clover content of the herbage throughout the five-year period. The average clover content of mixture No. 6 exceeded that of No. 1 owing to a very high percentage of clover during the first year of clipping. The growth of white Dutch clover appears to have been suppressed in the later years of the test by Kentucky blue grass.

Variety Test of Grasses and Clovers

Grasses.—During a four-year test period, eighteen species of grasses were grown in nursery rows to determine their adaptability to regional conditions. All species were cut several times during the growing season to determine their value for forage production. No attempt was made to assess the seed-setting ability. Winter hardiness was not a problem as all species showed 100 per cent survival. The most promising grasses were:

Orchard grass—(*Dactylis glomerata* L.)

Brome grass—(*Bromus inermis* L.)

Timothy—(*Phleum pratense* L.)

Creeping red fescue—(*Festuca rubra* L.)

Tall fescue—(*Festuca elatior* var. *arundinacea* Schreb. Wimm.)

Further trials are necessary to determine the most promising varieties within each species.

Clovers.—Nine species were grown and no winterkilling was observed. The red clover included in the test nursery had a tendency to assume a perennial habit of growth. The most promising clovers were:

Red clover (Ottawa)—(*Trifolium pratense* L.)

Ladino clover—(*Trifolium repens* L.)

Alfalfa Varieties.—Nine varieties were included and survived the winters. Further testing in replicated plots is now being undertaken to evaluate the varieties for forage production.

CEREALS

The cereal grains are the most important crops grown on the reclaimed river flats and, to a limited extent, on the upper bench area. Spring wheat, winter wheat, oats, and barley are the most widely grown. The greatest amount of these grains is marketed through the elevators and a limited amount is used for feed pruposes.

The primary considerations in selecting varieties suited to the district are strength of straw, yield, and quality. Resistance to the races of stem and leaf rusts must also be considered. Strength of straw is the most important agronomic factor since abundant spring moisture, along with the relatively low summer rainfall, results in long straw which is conducive to lodging.

Spring Wheat

During the six-year period twenty-eight varieties and selections have been grown in replicated experimental plots. These have been mainly of the hard red types which are of satisfactory milling quality. A limited number of soft white varieties have been tested but no market has been established for this kind of grain.

The recommended hard red varieties for the Creston district are Redman and Regent. Redman is growing in popularity and rapidly replacing Regent.

Redman.—Developed at Winnipeg by the Canada Laboratory of Cereal Breeding in co-operation with the Canada Laboratory of Plant Pathology from the cross Regent × Canus made in 1934. The straw is strong and of medium length. It is moderately resistant to lodging, and resistant to shattering and sprouting. Redman is resistant to bunt and black chaff, semi-resistant to loose smut and root rot, and moderately susceptible to leaf rust.

Regent.—Developed by the same institutions as Redman from the cross H-44 × Reward made in 1926. Compared with Redman it is of similar maturity, slightly weaker in the straw and more susceptible to leaf rust and root rot. It has also yielded lower than Redman when grown on the Creston reclaimed river flats.

TABLE 14.—RESULTS OF SPRING WHEAT VARIETY TESTS

Variety	Yield per acre (bu.)	Maturity (days)	Weight per bu. (lb.)	Strength of straw (1-9)*	Length of straw (in.)
	3-year average, 1949-51				
Redman	43·9	111	60·0	4·0	40
Cascade	42·4	110	59·0	7·0	45
Saunders	31·6	105	54·0	3·0	38
Marquis	41·4	109	60·0	6·0	44
Thatcher	37·9	109	57·0	5·0	40
4233-49	51·0	113	57·0	4·0	41
	3-year average, 1952-54				
Redman	46·3	107	61·0	1·5	34
Lee	43·8	109	61·0	1·5	34
Acadia	45·8	108	62·0	1·5	34
3669-17	45·8	108	61·0	3·0	35
R.L. 2651	54·4	108	62·0	1·5	36
R.L. 2624	51·5	107	61·0	1·5	36
4280-10	59·2	113	57·0	1·5	42
3813A	44·9	109	61·0	3·1	37
4256-4	51·8	108	61·0	2·5	36

*Scored on the basis of 1-9 with 1 being very strong.

In the first group of varieties reported on for the period of 1949-51 it can be observed that 4233-49 yielded higher than the standard variety Redman. This is a selection from (3226A41 × Fed. Dicklow) × 3226B and is a white soft selection. As yet no demand has been established for this type of wheat.

For the period 1952-54 four numbered selections yielded higher than Redman. Two are of the white soft type; namely, 4280-10 and 4256-4. The remaining selections, R.L. 2651 and R.L. 2624, are hard red selections but cannot be recommended for the area until licensed.

Oats

Although the acreage grown is less than that of wheat, this crop is increasing in importance. Improved varieties with greater resistance to lodging and higher yields have been the most encouraging factors. Eagle and Ajax are the recommended varieties with preference being given to Eagle because of its stronger straw.

Eagle.—An introduction from Sweden, the result of a cross between Victory and Von Lochow's Yellow. It resembles Victory in many respects but has a little shorter straw and is a few days earlier maturing. Eagle is considered susceptible to stem and crown rust but has not been affected by these diseases when grown on the Creston flats.

Ajax.—Developed at the Canada Laboratory of Cereal Breeding from a cross between Victory and Hajira. This variety is early maturing and high yielding. It is moderately resistant to stem rust and susceptible to crown rust. Only trace infections have been observed on this variety on the Substation test plots.

TABLE 15.—RESULTS OF OAT VARIETY TESTS

Variety	Yield per acre (bu.)	Maturity (days)	Weight per bu. (lb.)	Strength of straw (1-9)*	Length of straw (in.)
			3-year average, 1949-51		
Eagle	116·4	102	36·8	5·1	44
Ajax	118·2	103	37·4	6·5	47
Abegweit	117·2	104	36·4	7·7	45
Fortune	115·8	104	37·0	8·2	47
Larain	94·2	98	40·7	4·4	46
			3-year average, 1952-54		
Eagle	101·4	102	37·0	1·6	38
Ajax	101·9	101	37·0	2·0	40
Abegweit	111·1	105	37·0	2·0	40
Fortune	108·6	105	37·8	1·7	41
Rodney	105·3	105	38·7	1·7	39
4369-60	105·4	104	37·8	1·7	42
4369-50	117·7	104	36·5	1·3	40
4274-37-4	105·6	104	38·7	1·5	39
4367-122	90·7	103	37·8	1·6	38
3932-16	73·2	104	42·0	1·3	38
			6-year average, 1949-54		
Eagle	108·9	102	37·0	3·4	41
Ajax	110·1	103	37·0	4·2	43
Abegweit	114·2	105	36·6	4·9	42
Fortune	112·2	105	37·4	4·9	44

*Scored on the basis of 1-9 with 1 being very strong.

The 3932-16 selection is hulless and its yield is adjusted on the basis of 25 per cent hull.

There is little difference between Ajax and Eagle, but the latter is more resistant to lodging and is preferred by the farmers. The favorable yield received from 4369-50 exceeded both recommended varieties. This is a selection from a (Ardri × Beacon) × Laurel cross and was obtained from the Cereal Crops

Division, Central Experimental Farm, Ottawa. As yet this variety has not been licensed or named. For the six-year period the yields of Eagle and Ajax were exceeded by Abegweit and Fortune. The straw of the latter two varieties is weaker and not preferred by the growers.

Barley

A limited acreage of barley is grown on the Creston flats, but the acreage is increasing in connection with wild oat control. The chief objection in the past has been the difficulty encountered with lodging. In selecting varieties for testing this factor has been emphasized. The results of the barley variety tests are given in Table 16.

Vantage and Titan are recommended for the area. Vantage is high yielding and Titan more resistant to lodging.

Vantage.—A six-rowed, smooth-awned barley developed from a cross of (Newal × Peatland) × Plush made at the Experimental Farm, Brandon, Man. This is a feed barley and not accepted for malting. It is resistant to stem rust, susceptible to leaf rust, loose and covered smut, and very susceptible to leaf blotch. It is the leading variety being grown on the Creston flats and is preferred to Titan because of its higher yield.

Titan.—A six-rowed smooth-awned barley developed from a cross of Trebi × Glabron made at the University of Alberta, Edmonton, Alta. It is resistant to the common forms of loose smut and covered smut. Stem rust has been observed on this variety when grown on the river flats. The awns are persistent, making it difficult to thresh. Titan is more resistant to lodging and is recommended for growing on low areas where this condition is most likely to occur.

TABLE 16.—RESULTS OF BARLEY VARIETY TESTS

Variety	Yield per acre (bu.)	Maturity (days)	Weight per bu. (lb.)	Strength of straw (1-9)*	Length of straw (in.)
	3-year average, 1949-51				
Vantage	90·5	99	51·5	6·3	39
Olli	75·7	90	47·3	5·6	34
Montcalm	76·9	99	48·3	8·0	45
Titan	82·8	96	50·3	3·1	37
Plush	87·5	98	49·3	8·0	41
Newal	83·9	97	49·7	7·7	41
Gem	79·2	97	46·3	6·0	34
	3-year average, 1952-54				
Vantage	82·7	98	52·2	1·8	35
Olli	64·4	89	49·3	2·4	32
Montcalm	70·2	97	50·8	2·8	39
Harlan	78·2	96	48·7	1·9	31
Maja	88·5	101	51·7	3·0	29
Hannchen	75·2	99	52·8	4·5	24
	6-year average, 1949-54				
Vantage	86·6	99	51·8	4·1	37
Olli	70·0	89	48·0	4·0	33
Montcalm	73·4	98	49·6	5·4	42

*Scored on the basis of 1-9 with 1 being very strong.

The high yield and bushel weight obtained from Vantage, along with favorable strength of straw of Titan are the most impressive factors for the 1949-51 period. Lodging was more prevalent during the 1949-51 period as compared with 1952-54. The high yield of the two-rowed variety, Maja, is rather impressive, but it is susceptible to lodging. For the six-year period, Vantage has proved to be higher yielding, with higher weight per bushel, than Olli or Montcalm. Straw strength was similar to that of Olli.

Date of Seeding

The purpose of this project was to determine the effect of the date of seeding on grain yields and the possibilities of using barley as a means of controlling wild oats. Seeding was carried out at weekly intervals from May 6 to June 1. The varieties used were Olli and Plush.

Olli is a six-rowed rough-awned barley with very early maturity. The straw is short to medium in length and medium to strong in strength. It is acceptable for malting.

Plush is a six-rowed smooth-awned variety being mid-late to late in maturity. The straw is mid-long with medium strength. Plush is a feed barley and is not eligible for malting grades. At the time of starting this test it was recommended for the Creston flats and has since been replaced by Vantage.

TABLE 17.—RESULTS OF BARLEY TESTS FOR DIFFERENT DATES OF SEEDING

Variety	Weekly seeding dates May 6—June 1	Yield per acre (bu.)	Maturity (days)	Strength of straw (1-9)*	Length of straw (in.)
Olli	First	75·1	92	4·1	35
	Second	61·8	93	4·8	33
2-year average	Third	47·8	100	6·3	31
	Fourth	44·0	95	6·2	30
Plush	First	82·2	105	6·3	38
	Second	75·4	108	6·7	35
2-year average	Third	62·2	108	7·0	33
	Fourth	52·5	104	7·4	31

*Scored on the basis of 1-9 with 1 being very strong.

The highest yields were obtained from the earliest seeding with a gradual decline for later seedings. The maturity behavior was somewhat erratic, but in general the earliest seeding resulted in the earliest maturity. The straw from later seedings was weaker. The longest straw resulted from the earliest seedings. If the above varieties are to be seeded late as a wild oat control measure then lower yields can be expected.

Winter Wheat

Winter wheat is one of the most important cereal grains grown on the area served by this Substation. The demand for wheat of this type during the war years brought about an increase in acreage. In recent years the demand has lessened and the acreage reduced. Kharkov is the recommended variety for the area. The main objections to it are its straw weakness and lack of resistance to leaf rust.

Kharkov M.C. 22 is a selection that was made at Macdonald College in 1912 from Kharkov. The latter is a variety of Russian origin which was introduced into the United States in 1900. It is a winter-hardy, high quality, hard red winter wheat variety. The spike is mid-dense, tapering and awned. The straw is mid-tall, weak, and moderately susceptible to lodging. This variety is susceptible to bunt, leaf rust, and stem rust. Its main advantages for growing on the Creston flats are winter hardiness and high quality.

The variety tests of winter wheat grown at the Substation were carried out in co-operation with the Cereal Section, Experimental Station, Lethbridge, Alta. All varieties or selections included in Table 22 are of the white soft type with the exception of Kharkov M.C. 22.

TABLE 18.—RESULTS OF WINTER WHEAT TESTS

5-year average, 1950-54

Variety or selection	Yield per acre (bu.)	Weight per bu. (lb.)[2]	Strength of straw (1-9)[1]	Length of straw (in.)
Kharkov M.C. 22	55·6	63 3	7·0	51
Elgin	61·5	59·8	3·3	41
Brevor	80·5	62·6	1·4	39
Washington #24	77·4	62·9	1·1	36
Washington #25	74·3	63·0	1·4	38
Washington #31	80·7	64·0	2·1	39
Washington #38	69·5	63·5	2·1	38
Washington #39	73·7	63·4	1·9	39
Washington #42	78·3	63·8	1·8	41
Washington #45	84·9	65·0	1·6	42
Washington #51	85·8	63·6	2·7	41

[1]Scored on the basis of 1-9 with 1 being very strong.

[2]The bushel weights are based on a four-year average, 1951 to 1954, inclusive.

Maturity.—The small differences in maturity, amounting to five days, were not considered an important factor in evaluating the varieties. Harvesting of winter wheat is well in advance of frost or inclement weather conditions. The plots were harvested during the first two weeks in August.

The soft white varieties and selections produced higher yields than the standard hard red variety, Kharkov M.C. 22. Brevor was superior to Elgin in yield, bushel weight and strength of straw. Lodging was prevalent throughout the plots of Kharkov M.C. 22 during the five-year test period. The lack of resistance to lodging is the main objection to this variety. The future of the soft white varieties will depend on the demand for this type of grain.

FIG. 3.—The weak straw of Kharkov winter wheat is indicated in this badly lodged plot.

Rate of Seeding

This test was carried out to determine the most satisfactory rate of seeding for Kharkov winter wheat. Difficulty was being encountered by farmers in arriving at an optimum rate. Results are available for the years 1950, 1951, and 1953. A severely lodged and tangled condition of the grain in 1952 prevented harvesting. The results are given in Table 19.

TABLE 19.—YIELDS OF KHARKOV WINTER WHEAT FROM DIFFERENT RATES OF SEEDING

3-year average, 1950, 1951, and 1953

Seeding rate per acre	Yield per acre
bu.	bu.
0·50	41·8
0·75	45·9
1·00	49·9
1·25	54·1
1·50	52·7
1·75	52·2
2·00	54·1
2·50	54·1

Reduced yields were obtained on the rates lower than 1·25 bushels per acre. This rate was as favorable as the higher rates and showed that no increase in yield could be expected from higher rates of seeding.

Maturity.—The different rates had no effect on maturity. All plots were harvested on the same date.

Weight per Bushel.—Only small variations amounting to one-half pound were obtained and these were not considered significant.

Strength of straw.—In one out of the three test seasons, the three heaviest rates of seeding were more susceptible to lodging. For the two remaining seasons no differences could be detected.

Length of straw.—Only small differences amounting to two inches were observed. These were not considered significant.

Quality Tests

Grain samples harvested in 1950 were sent to the Cereal Crops Division, Central Experimental Farm, Ottawa, for milling and baking tests. Kharkov M.C. 22 was rated as medium-strong on the basis of bread wheat quality. All other varieties and selections were tested for soft wheat quality and rated from medium to weak in this respect.

Cereal Diseases

This work is carried out in co-operation with the Laboratory of Plant Pathology at Winnipeg, Man. Varieties of wheat, oats, barley, and flax are grown in a rust nursery in order to study the races which are prevalent as well as the degree of infection. Samples of the varieties are sent to the Laboratory for examination. It should not be inferred that the absence of any disease from a given rust nursery means that the disease was not present in that locality. The plants shipped to Winnipeg for examination were not mature and, although infection had occurred, it is possible that the maximum intensity of the disease had not been reached. The results are given in Table 20; the symbol Tr indicates that only a trace of rust was observed.

FIG. 4.—The soft white winter varieties have strong short straw. The 4 rows on the right are Elgin; center and left are Washington hybrids.

TABLE 20.—STEM RUST INFECTION OF WHEAT

(*Puccinia graminis tritici*)

Variety	Percentage infection					
	1949	1950	1951	1952	1953	1954
McMurachy	0	0	0	0	0	0
Lee	—	0	0	0	Tr	0
Kenya Farmer	—	—	—	0	0	0
Little Club	40	1	15	50	40	70
Marquis	40	1	10	40	40	50
Mindum	—	0	0	0	5	1
Thatcher	0	0	0	0	Tr	Tr
Selkirk	—	—	—	0	0	0
Norka	25	Tr	5	50	40	20
Redman	0	0	0	0	Tr	0
Exchange	20	Tr	Tr	20	20	1
Frontana	—	0	0	Tr	Tr	0
Carleton	0	0	0	—	—	—
Yaroslav Emmer	—	0	0	—	—	—

The intensity of the stem rust varies from year to year. The varieties, Marquis and Little Club, are very susceptible to the prevailing races. The recommended variety, Redman, is shown to be highly resistant. In the selection of varieties for the Creston area, resistance to stem rust is an important factor to be considered.

TABLE 21.—LEAF RUST INFECTION OF WHEAT

(*Puccinia triticina*)

Variety	Percentage infection					
	1949	1950	1951	1952	1953	1954
McMurachy	90	85	90	90	70	10
Lee	—	0	Tr	Tr	Tr	Tr
Kenya Farmer	—	—	—	—	—	Tr
Little Club	50	95	95	90	65	80
Marquis	80	70	90	80	60	15
Mindum	—	30	Tr	10	20	Tr
Thatcher	90	80	90	80	60	10
Selkirk	—	—	—	—	0	Tr
Norka	80	80	90	80	40	20
Redman	40	70	80	50	5	5
Exchange	5	Tr	0	Tr	Tr	5
Frontana	—	0	0	0	Tr	—
Carleton	50	1	1	30	5	—
Yaroslav Emmer	—	Tr	Tr	5	—	—

The infections of leaf rust of wheat are more severe than those of stem rust of wheat, as can be noted by comparing Tables 20 and 21. Many varieties are susceptible to races of leaf rusts that are prevalent in this area. Attention is being given to this problem.

Stem Rust Infection of Oats (*Puccinia graminis avenae*).—Stem rust of oats is not a problem in Creston district as the varieties of commercial importance are highly resistant. Of nine varieties tested for the years 1949 to 1954, inclusive, the variety, Bond, showed 50 per cent infection, Trispernia 35 per cent and Clinton 20 per cent in 1953. The amount of infection in these varieties for other years and for all varieties in the six-year period was negligible.

Crown Rust Infection of Oats (*Puccinia coronata avenae*).—Crown rust of oats is also of minimum importance. In the six-year period in which plant specimens were examined for this disease, no infections were found.

Leaf Rust Infection of Barley (*Puccinia hordei*).—Nine varieties of barley have been grown and the plant specimens examined over the six-year period. Three trace infections occurred on two varieties. Vantage showed a trace in 1949 and Goldfoil in 1949 and 1950. This disease does not appear to be an important factor in barley production. The results are given in Table 22.

TABLE 22.—STEM RUST INFECTION OF BARLEY

(*Puccinia graminis*)

Variety	Percentage infection					
	1949	1950	1951	1952	1953	1954
Montcalm	—	Tr	10	15	40	2
Black Hulless	—	—	—	—	—	2
Vantage	1	0	Tr	Tr	10	Tr
Peatland	—	0	2	1	20	Tr
Feebar	—	—	—	—	—	1
Wisconsin H. 106	3	0	Tr	5	30	—
U.M. 43-1020	—	—	1	1	30	—
Goldfoil	15	Tr	—	—	—	—
Gold	10	—	—	—	—	—

It can be observed that the disease intensity varies from year to year. In years when infections are severe, reduced yields can result in susceptible varieties.

Powdery Mildew (*Erysiphe graminis*).—Examination of the wheat and barley varieties grown on the Substation revealed that barley is more susceptible to this disease. The intensity and prevalence varies from year to year and was most prevalent in 1950. Trace to light infections were observed at varying intervals throughout the six-year period (1949-1954).

Leaf Blotch (*Septoria passerinii*).—The barley varieties grown at Creston in 1953 and 1954 were examined and found free of this disease.

Scald (*Rhynchosporium secalis*).—On plant specimens of the barley varieties grown in 1953 and 1954, this disease was not detected.

Flax Rust (*Melampsora lini*).—Plant specimens examined and grown in 1952 showed that the varieties, Dakota, Bison, and Rocket were free from this disease.

Flax

Flax is not grown to any great extent in the area served by the Substation. Early experiences on the part of growers was disappointing with the late and uneven maturing variety, Royal. Ten varieties have been tested during the six-year period, 1949 to 1954, inclusive. The results are given in Table 23. No results were obtained in 1953 on account of poor germination and abnormally thin stands. Only varieties which have been tested three years or more are considered for recommendation. The recommended varieties for the area are Redwing and Dakota.

Redwing.—An early maturing variety developed by the Minnesota Experimental Station by selection from Russian stock. It is of medium length with good strength of straw. The seed is reddish brown in color and very small in size. In disease reaction it is semi-susceptible to flax wilt and rust, but susceptible to pasmo. The quantity of oil obtained from the seed is low, but is of good quality.

TABLE 23.—RESULTS OF FLAX VARIETY TESTS

Variety	Yield per acre (bu.)	Maturity (days)	Weight per bu. (lb.)	Strength of straw (1-9)*	Length of straw (in.)
	5-year average, 1949-52, 1954				
Redwing	29·0	115	56·3	1·2	25
Dakota	28·5	118	55·0	1·3	25
Rocket	30·1	122	54·0	1·3	25
Victory	27·5	125	55·8	1·9	26
	3-year average, 1949-51				
Redwing	30·4	115	56·3	1·0	26
Dakota	29·6	118	54·8	1·2	25
Sheyenne	27·5	117	55·7	1·8	26
	3-year average, 1951, 1952, and 1954				
Redwing	27·4	117	55·5	1·3	25
Dakota	27·1	120	54·7	1·5	24
Redwood	29·6	128	55·0	1·5	25

*Scored on the basis of 1-9 with 1 being very strong.

Dakota.—This variety was selected by the United States Department of Agriculture from the cross Renew × Bison. It is uniformly medium in maturity. The seed is brown in color and of medium size. In disease reaction it is resistant to wilts, susceptible to flax rust, and moderately tolerant to pasmo. The oil content is fair, with good drying quality.

Although Rocket exceeded Redwing and Dakota in yield for the five-year period, the late maturity and low bushel weight are factors that more than offset the favorable yield. Sheyenne has not equalled the standard varieties in yield. Redwood has yielded well but takes one to two weeks longer to mature than the other varieties.

HORTICULTURE

During the period of this report, the testing of vegetable varieties as to their performance for commercial and home use has been the most important phase of horticulture work carried out at the Substation.

In general, the vegetables producing the highest consistent yields from year to year have been those requiring somewhat cool conditions. The root crops and cabbage have produced the highest yields of marketable vegetables. The heat-loving crops, such as corn and tomatoes, have varied widely in yields from year to year. The silty clay soil warms up slowly in the spring and the abundance of moisture resulting from a heavy snowfall contributes to this condition. Cool nights accompanied by heavy dews received during the late part of August and early September delay maturity.

Precipitation received in July is less than one inch, based on a 17-year average. This emphasizes the need for irrigation on the higher land areas which are the most suitable for vegetable production.

Several production problems, such as fertilizer needs and frost protectors, remain to be investigated.

Beans

A total of 24 varieties of beans have been grown during the period 1949-54. The date of planting has varied from year to year, with the earliest on May 8 and the latest on May 24, with the average date of planting being May 15. Rows were seeded 3 feet apart, with the beans being spaced 3 inches apart within the row. Table 24 gives the pod characteristics of the most important varieties of snap beans. These are important in evaluating quality.

TABLE 24.—POD CHARACTERISTICS OF SNAP BEAN VARIETIES

Variety	Shape	Size	Color	String	Uniformity
		in.			
Fullgreen #1	S–C	3·5–4·0	L.G.	8	8
Kinghorn Special	C	4·0–4·5	Y.	7	7
Pencil Pod Black Wax	C	3·5–4·5	Y.	7	7
Tenderlong	S–C	4·0–4·75	L.G.	7	7
Top Notch Golden Wax	S–SC	2·5–3·5	Y.	1	6
Cherokee Wax	S–C	4·0–4·5	Y.	8	7
Logan Improved	S–C	3·5–5·5	L.G.	9	4
Rival	SC–C	3·5–4·5	L.G.	8	6
Round Pod Kidney Wax	S–SC	4·5–4·75	Y.	7	7
Blue Lake	S–SC	4·0–5·0	L.G.	9	8
Contender	C	4·0–4·5	L.G.	7	7
Improved Commodore	C	4·5–5·5	L.G.	8	5
Stringless Green Pod	S–C	3·75–4·5	L.G.	8	7

Legend: Shape—S —Straight
SC—Slightly Curved
C —Curved

Color—L.G.—Light Green
Y. —Yellow

String—Scored on the basis of 1 to 10, with 10 indicating the beans to be free of string and 1 indicating a very stringy condition.

Uniformity—Scored on the basis of 1 to 10, with 10 indicating a high degree of uniformity and 1 indicating very poor uniformity.

The straight beans are considered the most suitable for canning. They are less wasteful as well as being more attractive and uniform when cut. Top Notch Golden Wax and Round Pod Kidney Wax were the most suitable of the yellow wax varieties. Blue Lake was the best of the green podded varieties.

Cherokee Wax was the most suitable of the wax varieties on the basis of string, and Blue Lake and Logan Improved were the best of the green varieties.

In the wax varieties the uniformity of the picked pods was very similar. Of the green podded varieties, Blue Lake showed the highest degree of uniformity.

TABLE 25.—YIELDS OF VARIETIES OF PICKED BEANS

(Tons per acre)

Variety	1949	1950	1951	3-year average
	tons	tons	tons	tons
Stringless Green Pod	2·87	4·00	2·23	3·03
Cherokee Wax	3·46	7·25	3·57	4·76
Fullgreen #1	3·59	6·50	3·80	4·63
Blue Lake	7·43	12·24	5·55	8·40
Average	4·34	7·49	3·79	

Variety	1950	1951	1952	3-year average
Blue Lake	12·24	5·55	3·08	6·96
Rival	6·01	3·30	2·39	3·90
Logan Improved	5·88	3·37	2·52	3·92
Improved Commodore	7·92	3·41	3·12	4·82
Blue Lake L.E.S.	12·60	8·12	4·18	8·40
Average	8·93	4·75	3·11	

The yields of the varieties of picked beans tested are given in Table 25. The table is made up of two periods of three years each in order to permit the yield evaluation of the greatest number of the most promising varieties. In comparing seasonal yields, which were made up of four pickings, a wide variation is particularly noticeable. Wide seasonal fluctuations in yields are undesirable from the standpoint of the commercial canneries.

The variety Blue Lake, obtained from the Horticulture Division, Central Experimental Farm, Ottawa, and the Blue Lake L.E.S., obtained from the Horticulture Section, Experimental Farm, Lethbridge, were the highest yielders during the period reported. The pod quality, as mentioned earlier, was also good.

One of the main problems encountered was that of low germination in the field. This condition appears to be more serious in the yellow podded wax varieties. Seed treatments with Spergon appear to be of little value.

Peas

During the six-year test period, an average of 14 varieties of peas were seeded each season. Difficulty is being encountered in obtaining normal stands. The variety Alaska produced a normal stand in three seasons out of the six. The remaining varieties were discarded for yield evaluation in five out of the six seasons because of thin stands resulting from low germination in the plots. Despite a delay in seeding during the later test years in an attempt to overcome low soil temperatures, thin stands have been obtained. Spergon was used as a seed treatment in two out of the six years but failed to improve germination and stands.

On the varieties for which yields were recorded in 1949, the late-maturing varieties produced the highest yields of shelled green peas. Radium, Prince of Wales, and Stratagem yielded 1·11, 1·10, and 0·91 tons per acre, respectively.

Under field or simulated field conditions when peas are grown for seed production or canning, higher rates of seeding have been used with drill rows six inches apart. The higher rate of seeding has assisted in overcoming the loss in stand resulting from low germination. Although stands slightly thinner than normal are obtained, it is difficult to estimate the reduction because of the closely seeded rows. Despite this difficulty, favorable yields of canning peas have been obtained at the Creston Substation when grown in test plots with the rows spaced six inches apart.

Consideration is being given to the problem of low germination by using higher rates of seeding and the testing of various seed protectants.

Vegetable Root Crops

Seven varieties of carrots, five of beets, and three varieties of parsnips have been grown in test plots during the six-year period. Two rows of carrots and beets were seeded in each replication in order to obtain yields of bunched and stored roots. One row from each replication was harvested for bunching and one row for storage yields. No thinning was carried out on the rows harvested for bunching purposes. The carrots grown for storage were thinned to two inches apart and the beets to three inches.

TABLE 26.—YIELDS OF CARROT VARIETIES PER ACRE

Variety	Grown for bunching (3-year av.)	Grown for storage (5-year av.)
	tons	tons
Amsterdam	3·49	10·35
Chantenay #27	3·09	11·35
Imperator	4·04	11·75
Nantes	3·22	12·24

In considering a dark root color as the most favorable, Imperator was the most satisfactory as a bunching carrot. Chantenay #27 was the darkest in color of the storage roots. Imperator and Chantenay #27 were also the most uniform in shape and size. In evaluating the varieties on the basis of all factors considered, Imperator appears to be a suitable dual purpose variety and Chantenay #27 the most suitable for storage purposes. The heavy silty clay soil at the Substation resulted in a considerable number of crooked distorted roots in the longer rooted varieties such as Amsterdam and Nantes. Many of the stored carrots had green tops and had to be discarded.

TABLE 27.—YIELDS OF BEET VARIETIES PER ACRE

Variety	Grown for bunching (2-year av.)	Grown for storage (3-year av.)
	tons	tons
XXX Globe	4·45	4·20
Early Flat Egyptian	4·66	2·48
Detroit Dark Red #6	5·78	5·51
Detroit Dark Red #16	3·55	4·50

The three latter named varieties had the most suitable color when harvested as bunching beets. Detroit Dark Red #16 had the best color of stored roots which also had the most uniform size and shape. The Detroit Dark Red varieties were the most suitable of the four varieties grown.

Parsnips

The varieties grown in test plots were Hollow Crown, Short Thick, and Harris Model. Short Thick was the most suitable of the three varieties. A high proportion of the roots of Hollow Crown and Harris Model were badly distorted and had to be discarded. The color of Short Thick is not quite so favorable as the other two varieties as it is slightly dark. Uniformity of root shape and size of the Short Thick was superior to the other varieties. It is considered that the heavy clay soil is responsible for root distortion.

Turnips

Purple Top Milan, an early white, and Laurentian, a late Swede type, have been grown at the Substation. The roots of the early white variety were somewhat rough and unattractive. Laurentian produced small unsuitable roots, which was due to the lack of midsummer precipitation. Recently, a small sprinkler irrigation system has been acquired and the testing of turnip varieties will be resumed.

Leafy Vegetables

Seven varieties of cabbage were grown during the period of this report. The plants were started in a local greenhouse and set out in the field plots in rows three feet apart, with an 18-inch spacing between plants. The early varieties were harvested during the second week in August and late varieties during the last week in September. The results are given in Table 28.

TABLE 28.—YIELDS OF CABBAGE VARIETIES

Variety	Yield per acre (3-year av.)
	tons
Viking	13·97
Golden Acre	12·74
Danish Ballhead	15·45

The varieties, Viking and Golden Acre, are early in maturity while Danish Ballhead is late maturing. Viking was the higher yielder of the early varieties but the late variety, Danish Ballhead, gave the highest yields. Production of all varieties is considered to be favorable.

Corn Varieties

All corn varieties grown in test plots are seeded in rows three feet apart and the plants are thinned to a foot apart when approximately two inches in height. Twelve varieties have been grown at the Substation. Yields per acre of unhusked cobs from the six most promising varieties are summarized in Table 29.

TABLE 29.—YIELDS OF CORN VARIETIES

Variety	Yield per acre (3-year av.)
	tons
Carmelcross 13-29	5·59
Dorinny	2·52
Golden Cross Bantam	2·68
Sugar Prince	5·20
Gold Rush	6·30
Banting	2·44

Gold Rush and Carmelcross 13-29 were the highest yielding varieties.

A fair degree of uncertainty prevails in the production of corn. The heavy soil on the reclaimed river flats does not permit early seeding. In two out of the six years of testing, frost damaged most of the varieties before picking. The higher levels of the reclaimed area would be more suitable for growing corn.

Tomato Varieties

All tomato varieties were started in a local greenhouse prior to planting in the field. Plants were set out two feet apart in the rows with a spacing of four feet between rows. Time of planting was approximately May 24. The results are given in Table 30.

TABLE 30.—YIELDS OF TOMATO VARIETIES

Variety	Yield per acre		
	2-year average	3-year average	4-year average
	tons	tons	tons
Quebec #5	12·16	9·46	7·72
Early Chatham	9·95	7·44	6·58
Early Lethbridge	10·11	7·72	7·11
Carleton	7·86	6·07	—
Monarch	11·53	8·99	—
Quebec #13	14·23	—	—
Mustang	13·85	—	—
Meteor	14·37	—	—

Three periods are included in the above table to permit the evaluation of the greatest number of varieties. The wide variations in yield averages indicate that this condition also prevailed from season to season. Yields were very erratic during the six-year period. A low of 1·10 tons per acre was recorded in 1950 for the variety Bestal and a high of 16·82 tons per acre for Mustang in 1952. Further experimental work will be necessary with fertilizers and frost protectors to discover means of increasing yields and yield consistency.

Potato Varieties

Although a considerable number of potato varieties have been grown at the Substation, only the most promising are presented. Difficulty was encountered in obtaining disease-free seed which prevented the continuity of testing some varieties over a period of years.

TABLE 31.—YIELDS OF EARLY POTATO VARIETIES

Variety	Yield per acre	
	2-year average	3-year average
	bu.	bu.
Irish Cobbler	153·0	—
Early Epicure	135·4	161·7
White Rose	231·8	233·3
Warba	130·1	—

As can be noted in Table 31, White Rose has proved to be the highest yielding early variety. Netted Gem has been grown as a late variety and has yielded 220·4 bushels per acre for a four-year average. The yields given are for marketable tubers.

Special Crops

The crops included in this section are market trials of green peas, fiber flax, soybean varieties, field bean varieties and field corn hybrids.

The purpose of the test with green peas was to determine its possibilities as a processing crop. Field conditions were simulated as closely as possible in carrying out the plot work. The varieties of fiber flax were grown over a period of years and the pulled flax was shipped to the Central Experimental Farm, Ottawa, for processing. The field corn varieties were tested to determine their possible use as a silage crop. The varieties of dry beans grown were those most widely used in the canning industry. Soybeans were tested for the purpose of evaluation as an additional cash crop. All of the above crops were grown in replicated plots in order to obtain accurate yield data.

Market Trials (Green Peas)

Seeding was carried out at the rate of four bushels per acre. Rows within the plots were spaced at six inches to simulate field conditions. The date of seeding ranged from May 11 to May 23 during the three-year test period.

TABLE 32.—GREEN PEA VARIETY TESTS

Variety	Days to harvest	Length of vine	Color*		
			Vine	Pods	Peas
	No.	in.			
Prince of Wales	78	34	D	M	M
Profusion	79	34	M	M	M
Wisconsin Early Sweet	66	33	L	L	L
Thomas Laxton	69	34	M	M	M
Little Marvel	69	19	D	D	D
Surprise	66	35	L	L	L
Perfection	71	22	M	M	M
Alaska	66	33	L	L	L

*Color: L—Light green
M—Medium green
D—Dark green

The number of days from seeding to time of harvest and the length of vine are based on a 3-year average (1950-1952). The color of vine, pods, and peas varied slightly from year to year and the above record is considered an average of the test period.

The early maturing varieties made up of Alaska, Wisconsin Early Sweet, and Surprise were only 3 to 5 days earlier than those of medium maturity, such as Thomas Laxton, Perfection, and Little Marvel. Profusion and Prince of Wales were latest in maturity and approximately ten days later than those of medium maturity. A wide range in maturity is considered beneficial as it lengthens the processing period.

A dark green color in peas is considered preferable to the medium or light green. All of the early varieties produced peas of a light color. The medium maturing varieties were of a better color, followed by those of late maturity.

The length of vine is important from the mechanical aspects of handling the crop. The long-vined varieties involve the handling of more weight in loading

and hauling the crop to the pea viners. The short varieties may also bring about problems in cutting as it is necessary to cut these varieties close to the soil surface. The rapid advances in machinery design may overcome these problems, but they should certainly be considered by the grower of canning peas.

TABLE 33.—GREEN PEA VARIETY YIELDS

3-year average, 1950-52

Variety	Pods per vine	Yield per acre		
		Vines Pods Peas	Pod Peas	Shelled Peas
	No.	tons	tons	tons
Prince of Wales	4	10·70	3·65	1·37
Profusion	5	9·75	3·89	1·60
Wisconsin Early Sweet	4	10·41	4·21	1·35
Thomas Laxton	4	10·28	4·57	1·62
Little Marvel	5	12·06	5·68	2·18
Surprise	4	8·72	3·64	1·47
Perfection	5	12·07	4·96	1·96
Alaska	3	9·79	3·86	1·33

In general, the varieties with the greatest number of pods per vine at time of harvest were the highest yielders. The weight of the total crop in the form of vines, pods, and peas provides information as to the yield of pea silage which can be expected. The total yield minus the weight of shelled peas would give the actual yield of silage per acre. The yield of pod peas is of value if part of the crop is to be sold on the fresh vegetable market. The most important factor in evaluating the varieties is the yield of shelled peas. Little Marvel produced the highest yield and the medium maturing varieties were the highest yielders. The late maturing varieties were next in order of yield, with the lowest being obtained from the early varieties.

TABLE 34.—SIEVE SIZES AND PERCENTAGE SHELLOUT OF GREEN PEA VARIETIES

3-year average, 1950-52

Variety	Sieve Size					Shell-out
	1	2	3	4	5	
	%	%	%	%	%	%
Prince of Wales	24	9	12	27	28	36
Profusion	28	6	9	22	35	40
Wisconsin Early Sweet	11	15	27	29	18	40
Thomas Laxton	14	10	8	19	49	40
Little Marvel	18	12	15	27	28	39
Surprise	20	20	25	20	15	40
Perfection	25	26	26	15	8	39
Alaska	26	19	31	12	12	35

The sieve sizes were determined by passing a weighed sample of shelled peas through the following sieves: Size 1 peas passed through a screen of 9/32 inch mesh. Size 2 peas passed through a screen of 10/32 inch mesh but not through a screen of 9/32 inch mesh. Size 3 peas passed through a screen of 11/32 inch mesh but not through a screen of 10/32 inch mesh. Size 4 peas passed through a screen of 12/32 inch mesh but not through a screen of 11/32 inch mesh. Size 5 peas passed through a screen of 13/32 inch mesh but not through a screen of 12/32 inch mesh.

In assessing the maturity groups on the basis of pea size, the size 1 peas were classified as small; sizes 2, 3, and 4 as medium; and size 5 as large. The early and medium maturing varieties were equal in percentage of small peas with a higher percentage being obtained from the late varieties. The early varieties produced the highest percentage of medium peas, followed by the medium and late maturing groups. The highest percentage of large peas was obtained from the late maturing varieties. The distribution of sizes is also being used as a guide to uniformity of size. The early varieties were the most uniform in size, followed by the medium and late maturing varieties. The high percentage of small and large peas in the late maturing group indicates the poorest uniformity in size.

Surprise was the most uniform in pea size, followed by Wisconsin Early Sweet. A high percentage of large peas is considered objectionable, with Thomas Laxton followed by Profusion being the highest. On the basis of the test, favorable yields of canning pea varieties can be grown on the reclaimed river flats. The assessing of quality is more difficult and can be accomplished only on the basis of processing trials.

Fig. 5.—Test plots of canning pea varieties at the Creston Substation.

FIBER FLAX VARIETIES

Seed for this project was obtained from the Central Experimental Farm, Ottawa. The seed was broadcast at the rate of 84 pounds per acre and the plots harrowed and rolled. The agronomic characteristics are given in Table 40. The performance data of Cascade is based on a three-year average, 1951-1953, inclusive. The remaining varieties are based on a five-year average, 1949-1953, inclusive.

TABLE 35.—AGRONOMIC CHARACTERISTICS OF FIBER FLAX VARIETIES

5-year average, 1949-53

Variety	Days to mature	Length of straw	Germination	Lodging
	No.	in.	%	%
Liral Dominion	103	33	81	5
Liral Prince	103	33	81	15
Stormont Cirrus	103	33	81	15
Gossamer L. 26	102	34	79	10
Cascade*	107	35	80	5

*3-year average, 1951-53.

Only slight differences in maturity were observed, all being well within the frost-free period. The small variations in length of straw and germination were not considered important in evaluating the varieties. Liral Dominion was the most resistant to lodging. The uniformity varied from year to year but no variety was considered better than any other.

TABLE 36.—FIBER CHARACTERISTICS AND SEED YIELDS OF FIBER FLAX VARIETIES

(Yield per acre)

1949-1953, inclusive

Variety	Retted straw	Line fiber	Tow	Seed
	lb.	lb.	lb.	bu.
Liral Dominion	3348	416·5	276·5	15·5
Liral Prince	3625	486·5	286·2	14·7
Stormont Cirrus	3553	472·5	281·7	15·3
Gossamer L. 26	3845	565·1	278·1	9·4
Cascade*	3900	459·0	295·8	12·1

*3-year average, 1951-53.

The necessary processing after the flax was pulled was carried out at the Central Experimental Farm, Ottawa. The results are given in Table 36. The yields of line fiber and tow show that flax can be grown successfully on the reclaimed river flats. Weeds were the most serious problem. These were separated from the flax at time of harvesting by means of pulling. On the basis of five years' results, Gossamer L.26 produced the highest yield of line fiber. Only small differences occurred in the yield of tow. Liral Dominion and Stormont Cirrus were the highest yielders of seed.

SOYBEAN VARIETIES

Five varieties were grown during the 3-year period 1949-1951, inclusive, and failed to reach maturity. The varieties grown were Mandarin, Flambeau, Kabott, Pagoda, and Capital. A heavy growth was obtained on all varieties, but the cool soil conditions resulting from the silty clay soil delayed maturity. The introduction of earlier varieties may warrant further testing.

FIELD BEAN VARIETIES

Seven varieties were grown in test plots during the period 1949-1951, inclusive. Two years' results are available as the 1951 crop was immature when damaged by frost. The performance of this crop at the Substation indicates that earlier maturing varieties are required if the risk in growing is to be reduced. All varieties were seeded in replicated plots with a 22-inch spacing between rows. The results are given in Table 37.

TABLE 37.—RESULTS OF FIELD BEAN VARIETY TESTS

2-year average, 1949-50

Variety	Days to mature	Length of vine	Yield per acre
	No.	in.	bu.
Luther Burbank	128	28	43·4
Great Northern #5	126	31	51·1
Great Northern #123	131	31	39·3
Great Northern Bozeman	130	33	44·0
Hidatsa	126	32	48·5
Yellow Eye	130	28	25·8
Red Mexican	125	28	50·4

Great Northern #5 produced the highest yield and was the most promising of the medium size white varieties. Red Mexican was not significantly lower in yield and was the highest yielding colored variety. The low yield of Yellow Eye was due to considerable shattering. Luther Burbank was the highest yielder of the small white varieties.

Observations at time of harvesting indicated that considerable variation occurred in the amount of shattering. Yellow Eye was the most susceptible to shattering, followed by Luther Burbank. Lack of uniformity in ripening was most evident in Great Northern #123, Great Northern (Bozeman), and Luther Burbank. The maturity of the varieties ranged from 125 to 131 days. Earlier maturing varieties are required if harvesting is to be carried out within the frost-free period of 127 days (17-year average). Defoliation may help in hastening maturity and remains to be investigated at the Substation.

There was a considerable quantity of soil lumps present in the threshed beans. This was caused by the silty clay adhering to the roots of the plants which were pulled at harvest time. Considerable cracking occurred in the beans when being threshed. The small white varieties appeared to be the most susceptible to cracking.

FIELD CORN VARIETIES

Eight hybrids were included in a test to determine their yields as a silage crop. The rows were spaced three feet apart and the plants thinned to one foot apart within the row when approximately three inches high. The dates of seeding for the three-year test period varied from May 10 to May 21. No chemical fertilizers nor manure were applied to the testing area. The results are given in Table 38.

TABLE 38.—RESULTS OF HYBRID FIELD CORN TESTS

Green yield per acre

3-year average, 1949-51

Hybrid	Percentage stand	Plant height	Cob height	Yield per acre
	%	in.	in.	tons
Canada #240	95	77	32	14·08
Canada #250	68	76	30	8·58
Canada #275	77	83	39	12·77
Canada #355	93	84	39	14·67
Canada #531	86	92	42	16·43
Canada #606	93	92	42	17·29
Canada #625	77	95	42	14·09
Canada #696	48	95	46	8·99

Early maturity—Canada #240 and #250.
Medium maturity—Canada #275 and #355.
Late maturity—Canada #531, #606, #625, and #696.

The early hybrid, Canada #250 and the late hybrid, Canada #696, produced the thinnest stands. No attempt was made to determine the highest yielder on the basis of 100 per cent stand. All the seed was checked for germination prior to planting and considered satisfactory. The variations in percentage stand appear to be due to varietal reaction to low soil temperatures.

The late maturing hybrids, Canada #606 and Canada #531, produced the highest green yield of the eight hybrids on test.

FIELD DAYS

Each year a field day is held during the growing season to give the farmers of the district the opportunity of inspecting the experimental work being undertaken at the Substation. These meetings also provide the opportunity of releasing general information on experiments that are in progress.

LIST OF ACTIVE PROJECTS

Soil Fertility

Chemical Fertilizers: Study of rates of application
The Effect of Chemical Fertilizers on Cereals
Small Fruit Fertilizer Test

Cereals

Testing Cereal Varieties
Winter Hardiness of Fall Seeded Grain

Forage Crops

Grass Legume Mixtures for Hay
Alfalfa Varieties for Hay
Adaptation of Grasses and Clovers
Cultivated Pasture Seeding and Management Studies

Horticulture

Garden Vegetable Variety Trials
Small Fruit Variety Trials.

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